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Event Differentiation in Service-Oriented Information Systems

Harry Katzan Jr.
Savannah State University, katzanh@savstate.edu

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Harry Katzan, Jr.
Savannah State University
katzanh@savstate.edu

ABSTRACT

In service-oriented information systems, a *methodology* is needed to distinguish one service from another and to define classes of services. A DNA of services is proposed consisting of a service DNA sequence of five letters corresponding to a five-dimensional quadrant-based scale. Each type of service is assigned a DNA sequence. If two services have the same DNA sequence, then they are in the same service class. The methodology provides a basis for classifying services for service-oriented architecture and information systems.

Keywords Service Science, Information Systems, Service DNA Sequence

INTRODUCTION

In service-oriented information systems, a *methodology* is needed to distinguish one service from another and to define classes of services. A DNA of services is proposed consisting of a service DNA sequence of five letters corresponding to a five-dimensional quadrant-based scale. Each type of service is assigned a DNA sequence. If two services have the same DNA sequence, then they are in the same service class. The methodology provides a basis for classifying services for service-oriented architecture and information systems.

A *service* is a provider/client interaction that creates and captures value. A unique characteristic of services is that both parties participate in the transaction, and in the process, both capture value. In a sense, the provider and the client co-produce the service event, because one can't do without the other, even though the provider may be a computer application and the client may be a person.

SERVICE CLASSES

Service classes are commonly established in one of two ways. Using deductive logic[1], we bring into play the notion of a concept and restrict our thinking to a specific domain. We can view this process as one of looking at the world through a special lens focusing on concepts that eventually lead to classes of service. Using inductive logic, objects with common characteristics are grouped into classes and represented by concepts. We can work forwards from object to concept because we are dealing with socially constructed phenomena[2].

Concepts

A *concept* is an abstract idea or mental representation that facilitates the recognition of and reference to objects in a specific area of interest, allowing us to omit the differences between things by abstracting their common characteristics.

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[1]For a description of deductive and inductive logic, see Sutherland [12].
[2] For a description of social constructivism, see Katzan [6].

Service Classes and Events

Concepts lead to classes that lead to objects. A *class* is a material representation of a concept and an *object* is an instance of a class. Here is a *hypothetical* example from the personal services domain:

Service Universe: Services performed on a person
Service Concept: Medical provisioning
Service Class: Physician/patient
Service Event: Individual visit to the doctor

In this instance, the service model is "physician/patient" conceptualized as medical provisioning within the service universe "services performed on a person. Even though the example is not definitive, it demonstrates that service characteristics can be used to define classes of service models.

SERVICE DIMENSIONS

IBM Almaden Services Research[3] and Fitzsimmons and Fitzsimmons have identified five dimensions along which we can classify services:

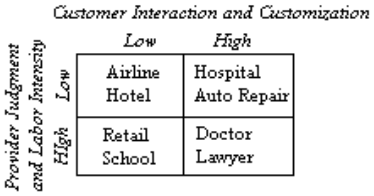
I. *Service Process* – using the degrees of Customer Interaction and Customization (by the provider) and Provider Judgment or Labor Intensity as metrics
II. *Service Nature* – using the Service Object and Service Result as metrics
III. *Service Delivery* – using Service Scheduling and Service Mode (continuous or discrete) as metrics
IV. *Service Availability* – using Service Site and Service Execution (who travels) as metrics
V. *Service Demand* – using Demand Fluctuation and Service Capacity as metrics

We can use the five dimensions as service model generators.

Service Process Dimension

Each dimension can be conceptualized as one view of a class of service models, and collectively, the five dimensions define a service universe. It is useful to think of the service universe as a point of view regarding the multiplicity of services that exist in a socially-constructed world. The Service Process dimension is employed as an introductory example.

Here is how it works. Each dimension can be viewed as a matrix, such as the following for Service Process[4]:



Each quadrant suggests a different service model, and the contents of that quadrant are examples of that type of service arrangement. Applied to a physician/patient service interaction, we have the following description along the service process dimension:

Service Process: Provider Judgment or Labor Intensity (high),
Client Interaction and Customization (high)

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[3] IBM Almaden Services Research [2] and Fitzsimmons and Fitzsimmons [1].
[4] The service diagram in the IBM report are adapted from Fitzsimmons and Fitzsimmons.

Clearly, this is a very good start to defining classes of service, but there are a few open items, such as the specification of the service object on which the service is performed. Accordingly, the Service Process is a necessary condition but not a sufficient condition for defining a service model[5].

Service Metrics

The service metrics deserve some consideration. The *Customer Interaction and Customization* metric refers to the degree of specific attention given by the provider to the client during the entire service event. When a client engages an airline seat or a hotel room, the facility is one of a select few possibilities and only a requisite amount of service is given to the client afterwards. With hospital service or auto repair, the service is unique to each client. The *Provider Judgment or Labor Intensity* metric can refer to three possibilities: (1) The amount of time the client receives attention when in the service process; and (2) The amount of time the provider is giving service when in the service process; and (3) The level of knowledge the provider brings to the service event. The service metrics are not precise in all cases; but it should be noted that our ultimate objective is to identify classes of service and not describe specific service events. (This comment will applies to the other service dimensions, as well.)

Service Nature, Delivery, Availability, Demand Dimensions

The other four dimensions are established in a similar manner. A summary description of the dimensions and the associated metrics are given in Table 1. Continuing with the physician/patient service interaction and applying the additional service dimensions, we come up with the following list:

Service Process:	Provider Judgment or Labor Intensity (high), Client Interaction and Customization (high)
Service Nature:	Service Result (tangible), Service Object (people)
Service Delivery:	Service Scheduling (formal), Service Mode (discrete)
Service Availability:	Service Site (single site), Service Execution (client travels)
Service Demand:	Demand Fluctuation (narrow), Service Capacity (not flexible)

The physician example is complete in the sense that we have created a conceptual view of a medical provisioning service along the five dimensions.

Service Considerations

It is important to recognize that a service model is not normative. For example, it doesn't tell you whether to go to a physician or a chiropractor. It doesn't tell you how to combine services or develop a service system. A service model defines one point in a five dimensional Cartesian space representing a class of services.

THE DNA OF SERVICES

The previous section introduced the notion of a five dimensional Cartesian space, called a *service hyperspace*, that is used to represent services and establish service models. In this section, we are going to introduce how the service hyperspace can be used to uniquely define classes of service. The DNA of services[6] is used to delineate points in the service hyperspace.

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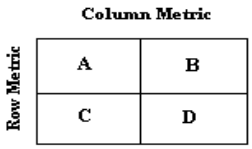
[5]See Sampson and Froehle [10].

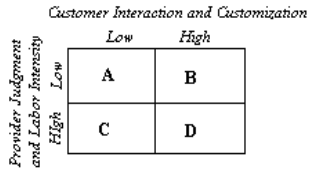
[6] In this instance, DNA is an acronym recursively defined as "DNA is Never Ambiguous."

Characterization of the Service Matrices

It is useful to characterize the information inherent in a service matrix as a set of quadrants, as follows:



Super imposing the set of quadrants on the Service Process matrix, for example, is reflected in the following diagram:



Quadrant A represents a ***Low*** value for the Customer Interaction and Customization (CIC) metric and a ***Low*** value for the Provider Judgment or Labor Intensity (PJL) metric. Similarly, quadrant D represents a ***High*** CIC value and a ***High*** PJL value, and so forth. The next step is to map the quadrants to a quadrant-based scale for representation in a service hyperspace.

Quadrant-Based Scale

Continuing with the Service Process example, a service with ***High*** CIC and ***Low*** PJL values is given a value of B on the following quadrant-based scale:

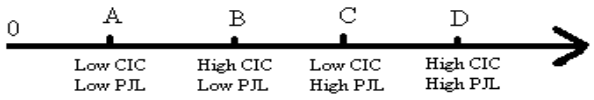


Table 1 gives the quadrant-based scales for the five dimensions in the service-quadrant hyperspace. Each dimension has a quadrant-based scale determined by the values for the associated metrics. Consider, for example, dimension #2: Service Nature. If the value for the Service Result metric is ***Tangible*** and the value for the Service Object metric is ***Possession***, then the quadrant-based scale value for dimension #2 Service Nature is B.

Here is where the service DNA sequence comes in. Each service model has a unique DNA sequence, based on the Quadrant-Based scale values for each of its dimensions. Moreover, the various dimensions have an order based on the dimension numbers given in Table 1.

Recall the physician example given earlier in the paper. From Table 1, dimension #1 (Service Process) has a DNA sequence value of D, because its value for the metric Provider Judgment or Labor Intensity is ***High*** and the value for the metric Client Interaction and Customization is also ***High***. Similarly, dimension #2 (Service Nature) has a DNA sequence value of A, because its value for the metric Service Result is ***Tangible*** and the value for the metric Service Object is ***People***. Using the same thinking, dimension #3 (Service Delivery) has a DNA sequence value of C; dimension #4 (Service Availability) has a DNA sequence value of A; and finally, dimension #5 (Service Demand) has a DNA sequence value of D. So the complete service DNA sequence for the physician model is DACAD.

Dimension #1: ***Service Process***

Provider Judgment/Labor Intensity	Customer Interaction/Customization	Quadrant-Based Scale
Low	Low	A
Low	High	B
High	Low	C
High	High	D

Dimension #2: ***Service Nature***

Service Result	Service Object	Quadrant-Based Scale
Tangible	People	A
Tangible	Possessions	B
Intangible	People	C
Intangible	Possessions	D
Tangible	Information	E
Intangible	Information	F

Dimension #3: ***Service Delivery***

Service Mode	Service Scheduling	Quadrant-Based Scale
Continuous	Formal	A
Continuous	Informal	B
Discrete	Formal	C
Discrete	Informal	D

Dimension #4: ***Service Availability***

Service Execution	Service Site	Quadrant-Based Scale
Client Travels	Single Site	A
Client Travels	Multiple Sites	B
Provider Travels	Single Site	C
Provider Travels	Multiple Sites	D
No Travel	Single Site	E
No Travel	Multiple Sites	F

Dimension #5: ***Service Demand***

Service Capacity	Demand Fluctuation	Quadrant-Based Scale
Flexible	Wide	A
Flexible	Narrow	B
Not Flexible	Wide	C
Not Flexible	Narrow	D

Table 1. Quadrant-Based Scales for the Five Dimensions in Service Hyperspace.

Information Systems Service DNA Sequence

The service customarily known as a "web search" is represented by the following script:

Service Process: Provider Judgment or Labor Intensity (high),
Client Interaction and Customization (low)
Service Nature: Service Result (tangible),

	Service Object (information)
Service Delivery:	Service Scheduling (informal),
	Service Mode (discrete)
Service Availability:	Service Site (single site),
	Service Execution (no travel)
Service Demand:	Demand Fluctuation (wide),
	Service Capacity (flexible)

The key attributes of this kind of service is that neither the client or provider travels, and the labor intensity is high, because sophisticated software is required, but the service in normally not customized for each client. The activity is not scheduled and takes a finite time. The demand varies widely and the provider usually has limited capacity to perform the service. The service DNA sequence for this information system service model is CEDEC.

MODELS, CLASSES, AND OBJECTS

Each service model can be uniquely identified by a service DNA sequence. But, what if two models have the same DNA sequence? It could easily happen since many services have the same signature, as in the following examples: If two service models have the same service DNA sequence, then they are in the same class, as defined previously. We can also construct a service DNA sequence representing a service class with no instances (i.e., objects). Because service systems are socially constructed forms of knowledge, we are not constrained by nature to describe only what exists. We can be innovative and design service systems to satisfy a variety of needs.

FUTURE RESEARCH

Service-oriented information systems are assimilated from objects in a service universe. A methodology has been given for general service events. The next step in this research is to define dimensions specifically related to information systems and develop relevant case studies. Some tweaking is expected to adequately represent information systems, and it is anticipated that additional dimensions will be required.

REFERENCES

1. Fitzsimmons, J.A. and M.J. Fitzsimmons (2006) *Service Management: Operations, Strategy, Information Technology* (5th Edition), New York: McGraw-Hill Irwin.
2. IBM Almaden Services Research (2006) *SSME: What are services*? http://almaden.ibm.com/ssme.
3. Katzan, H. (2007) *A View of Services Science*, Southeast Decision Science Institute, Savannah, GA, February 21-23, 2007.
4. Katzan, H. (2007) *A Client's View of Service Systems*, Decision Science Institute Mini Conference on Service Science, Carnegie Mellon University, Pittsburgh, PA, May 24-26, 2007.
5. Katzan, H. (2007) *A Client's View of the Quality of Service Systems*, Decision Science Institute Mini Conference on Service Science, Carnegie Mellon University, Pittsburgh, PA, May 24-26, 2007.
6. Katzan, H. (2007) *Foundations of Complex Adaptive Service Systems*, International Decision Science Institute, Phoenix, AZ, November 17-20, 2007.
7. Katzan, H. (2007) *A Reductionist Approach to Service Systems*, International Decision Science Institute, Phoenix, AZ, November 17-20, 2007.
8. Maglio, P.P. and J. Spohrer (2007) *Fundamentals of Service Science*, IBM Almaden Research Center, San Jose, CA.
9. Martin, J. and J.J. Odell (1998) *Object-Oriented Methods: A Foundation* (2nd Edition), Upper Saddle River: Prentice Hall.
10. Sampson, S.E. and C.M. Froehle (2006) "Foundations and Implications of a Proposed Unified Services Theory," *Production and Operations Management*, Vol. 15, No. 2 (Summer, 2006), pp. 329-343.
11. Spohrer, J., Maglio, P.P., Bailey, J., and D. Gruhl (2007) *Steps Toward a Science of Service Systems*, IBM Research, Almaden Research Center, San Jose, CA, www.almaden.ibm.com/asr.
12. Sutherland, J.W. (1975) *Systems*: *Analysis, Administration, and Architecture*, New York: Van Nostrand Reinhold Co.